AIRCRAFT WITH A COCKPIT INCLUDING A VIEWING SURFACE FOR PILOTING WHICH IS AT LEAST PARTIALLY VIRTUAL

[0001] The invention concerns a cockpit for a civil transport aircraft, that is to say for a commercial aircraft transporting passengers, their baggage and/or goods. The cockpit is the space reserved for the pilots. It contains all the controls (controls for actuating control surfaces, lift-increasing flaps and the like, controls for actuating the landing gear, the engines, the air-brakes, etc.) and the instruments necessary for piloting the aircraft. Conventionally it is always located at the front of the fuselage, in a region of the aircraft called the nose, provided with wide front and lateral window panes giving the pilots an unobstructed view not only forward of the aircraft, but also downward for the phases of landing and locomotion on the ground. In all that follows, "nose" is used to mean the whole of the front part of the fuselage, of modifiable form configured to receive the crew, which extends forward generally from a rear partition of the cockpit or of a resting area for the crew in a conventional aircraft, and which comprises a radome and a housing for a front landing gear.

[0002] For aerodynamic reasons, the nose should ideally be lancet-shaped. However, the housing in the nose for radar, a landing gear, and especially for the cockpit, requires a much more complex shape and structure to be provided, with numerous radii of curvature. In particular, the presence of the cockpit requires a large glazed surface to be provided in order to give operational physical visibility and to meet the rules and requirements for certification, such a glazed surface being very heavy which requires numerous structural reinforcements to be put in place which increase the mass of the aircraft still further.

[0003] In order to optimize the view outside and in particular to limit the problems of optical distortion and the impact on the aerodynamics of the aircraft, the front panes are preferably flat or have a dual curvature with large radii, and this adds still further to the weight for the glazed part.

[0004] What is more the positioning of the cockpit at the front of the aircraft extending in line with the passenger cabin reduces the size of that cabin all the more and the number of passengers capable of being received or their comfort, thereby limiting the financial profits for the airline company exploiting the aircraft.

[0005] The invention is directed to mitigating these drawbacks by providing an aircraft having a new cockpit of which the impact on the mass and on the aerodynamics of the aircraft is significantly reduced.

[0006] Another object of the invention is to enable the payload the aircraft can take aboard to be increased.

[0007] The invention is also directed to increasing safety, in particular by improving the pilot's perception and awareness of the outside scene forward of the aircraft.

[0008] For this, the invention concerns an aircraft including a cockpit comprising a surface, referred to as viewing surface for piloting, giving at least one pilot a view of an outside scene comprising the environment of the aircraft extending forward of the aircraft. The aircraft according to the invention is remarkable in that at least part of said viewing surface for piloting is free of any glazed surface and is formed by display means for a digital image representing at least part of an outside scene comprising the environment of the aircraft extending forward of the aircraft.

[0009] Thus, at least part of the windshield assembly through which, in the cockpit of the prior art, the pilot may see the outside scene forward of the aircraft, is virtual in the cockpit according to the invention. This windshield assembly part is replaced by a digital image, that is to say that at least part of the outside scene as viewed by the pilot is a virtual reconstitution of the real environment of the aircraft. The replacement of at least part of the glazed surface by display means for a digital image gives the possibility of improving the aerodynamics and of lightening the structure, and thus the weight, of the aircraft nose.

[0010] It is to be noted that the outside scene which the pilots may observe in a traditional aircraft is limited to the environment extending forward of the aircraft from the nose. As will be seen on reading the following description, the invention enables the pilot to be offered the choice between several outside scenes, while it is to be noted that, for the needs of piloting, the outside scenes offered include the environment forward of the aircraft.

[0011] Advantageously and according to the invention, the display means comprise one or more of the following means:

[0012] a screen and associated means for projection (including back-projection)

[0013] a device with lasers for forming a holographic image.

[0014] The digital image of the outside scene may be an image projected onto a screen or take on the form of a hologram or any other form.

[0015] This digital image of the outside scene may be formed from video data supplied by an on-board video camera, disposed for example at the front of the aircraft or in a fin of the aircraft, and/or on the basis of data stored in data banks or supplied by other video cameras. For example, when the aircraft is in locomotion on the ground and approaches a parking place in an airport, the projected image may be formed by a 3D reconstitution of the airport, stored in a data bank stored in a computer server on the ground, or captured by a video camera, in which reconstitution are embedded images termed circumstantial images, representing any obstacles currently present in the outside scene (such as an aircraft present at another parking place for example or any other vehicle passing within the zone), these incidental images coming from data supplied by an airport management service or by a video camera of the airport.

[0016] Where the screen only covers part of the viewing surface for piloting, the rest of the viewing surface for piloting is formed by in the usual manner by glazed surfaces. As the total surface area of the glazed surfaces of the aircraft is reduced, the aircraft is made lighter.

[0017] Furthermore, the glazed surfaces of the cockpit according to the invention may be of smaller size than those provided in the aircraft of the prior art. The structural reinforcements required for their integration into the structure of the aircraft are thus less or are even totally unnecessary, which also contributes to reducing the mass of the aircraft. Preferably, each of the glazed surfaces which the viewing surface for piloting may possibly comprise has a sufficiently small surface area to be able to be integrated between two frames of the aircraft or, in the case of an aircraft with a composite structure, to be able to be integrated with a minimum of reinforcements (the maximum allowable surface area for each glazed surface depends on the form of the fuselage, and in particular on the diameter of the aircraft). The reduction of the glazed surfaces of the aircraft furthermore makes it possible to adopt a perfect lancet shape for the nose, which